5/25/16

"Coming together is a beginning keeping together is progress working together is success."
-Henry Ford

HW: "Independent and Dependent Events" homework section #1-3
Test 3 Friday 6/3

AIM: How do we know if events are independent/dependent?

Warm Up:

***Exercise* #1:** Classify each of the following scenarios as having events that are dependent or events that are independent.

(a) A person pulls a red marble out of a bag that has 5 blue and 7 red marbles and does not replace it. Then a person pulls another red marble. Is the probability of pulling the second red marble out dependent on pulling the first red marble? Explain.

$P(\text{red}) = \frac{7}{12}$ Dependent

$P(\text{red}_{2^{nd}} \mid \text{red}_{1^{st}}) = \frac{6}{11}$

(b) A person flips a coin and notes that it comes up heads. Then the person rolls a standard six-sided die and notes that it comes up as a number less than three. Is the probability that the number came up less than three dependent on getting a head when flipping the coin? Explain.

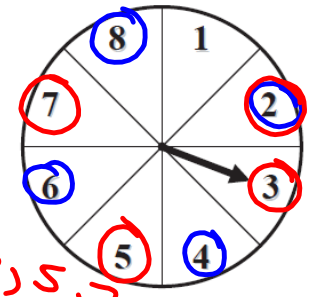
Independent.

$P(\text{less than 3}) = \frac{2}{6} = \frac{1}{3}$

$P(\text{less than 3} \mid \text{head}) = \frac{2}{6} = \frac{1}{3}$

The idea of **independence** is one that comes fairly naturally, but is important in order to see if there are associations amongst two events. Let's develop a tool to test dependence.

Exercise #2: The spinner below is spun once and its outcome is noted. Let E be the event of getting an even, let P be the event of getting a prime, and let L be the event of getting a number less than 5. Find the following probabilities:



(a) The probability of getting an even, i.e. $P(E)$.

$P(E) = \frac{4}{8} = \frac{1}{2} = 50\%$

(b) The probability of getting an even given that the outcome was a prime number, i.e. $P(E|P)$

given that its prime
What is P(even number)

Sample

Prime: 2, 3, 5, 7

$P(E|P) = \frac{1}{4} = .25$ **25%**

(c) The probability of getting an even given that the outcome was a number less than 5, i.e. $P(E|L)$. $L = 1\ 2\ 3\ 4$

$P(E|L) = \frac{2}{4} = \frac{1}{2}$ **50%**

(d) Which event does E depend on, P or L? How can you tell? What is a reasonable test?

$P(E) = P(E|P)$?

$50\% \neq 25\%$

Not therefore they are dependent

$P(E) = P(E|L)$

$50\% = 50\%$

Independent

DEFINITION OF INDEPENDENT EVENTS

Two events, A and B, are defined to be independent of another if:

$P(A \mid B) = P(A)$ and likewise $P(B \mid A) = P(B)$

Exercise #3: A survey of 57 sixth graders was done to determine which subject was their favorite. The results are shown in the table below sorted by gender.

	Math	English	Social Studies	Science	Total
Female	8	6	10	6	30
Male	10	4	9	4	27
Total	18	10	19	9	57

(a) Does it appear, based on the data in this table, that the preference for math as a favorite subject has dependence on a student's gender? Show the analysis and explain your findings.

$P(\text{Math} \mid \text{Male}) = \frac{10}{27} = .37$ $P(\text{Math}) = \frac{18}{57} = .32$

Math and Male are dependent.

(b) Does it appear, based on the data in this table, that the preference for social studies as a favorite subject has dependence on a student's gender? Show the analysis and explain your findings.

$P(SS) = \frac{19}{57} = .33$

$P(SS \mid \text{Female}) = \frac{10}{30} = .33$

Independent b/c Probability doesn't change.

There is a nice test for dependence that can be applied easily and comes from our formula for conditional probability from the last lesson.

Exercise #4: Given that $P(A \mid B) = \frac{P(A \text{ and } B)}{P(B)}$, do the following.

(a) If A and B are independent, then rewrite this formula and solve for $P(A \text{ and } B)$.

$P(A \mid B) = P(A)$

$P(B)\ P(A) = \frac{P(A \text{ and } B)}{P(B)} P(B)$

$P(A) \cdot P(B) = P(A \text{ and } B)$

(b) The probability that a person is ~~left handed~~ is 12%, the probability they have brown eyes is 42%, and the probability they have brown eyes and are left handed is 2%. Is the event of having brown eyes independent of being left handed? Support your answer.

$P(L) = .12$

$P(Br) = .42$

$P(L \text{ and } Br) = .02$

$(.12)(.42) = (.02)$

$P(L) \cdot P(Br) = P(L \text{ and } Br)$

$.0504 \neq .02$

dependent